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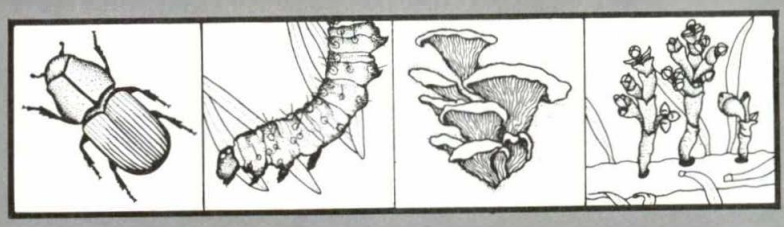
Forest Pest Management



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PROGRESS REPORT ON SPRUCE BUDWORM DAMAGE IN THE WALL CREEK AREA BEAVERHEAD NATIONAL FOREST

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INTRODUCTION

In 1979 spruce budworm defoliation in the Wall Creek area, Beaverhead National Forest, was heavy. Defoliation in the area had been intense for about 6 years and trees were beginning to deteriorate. Some mortality had already occurred, and top killing and thin crowns were evident in most stands. Wall Creek was selected for detailed tree examinations because of concerned land managers. Also a CANUSA 1/ researcher was interested in measuring effects of spruce budworm defoliation in areas of elk winter range. Wall Creek has been designated as a winter range for elk in adjacent State-owned lands managed specifically for big game.

OBJECTIVE

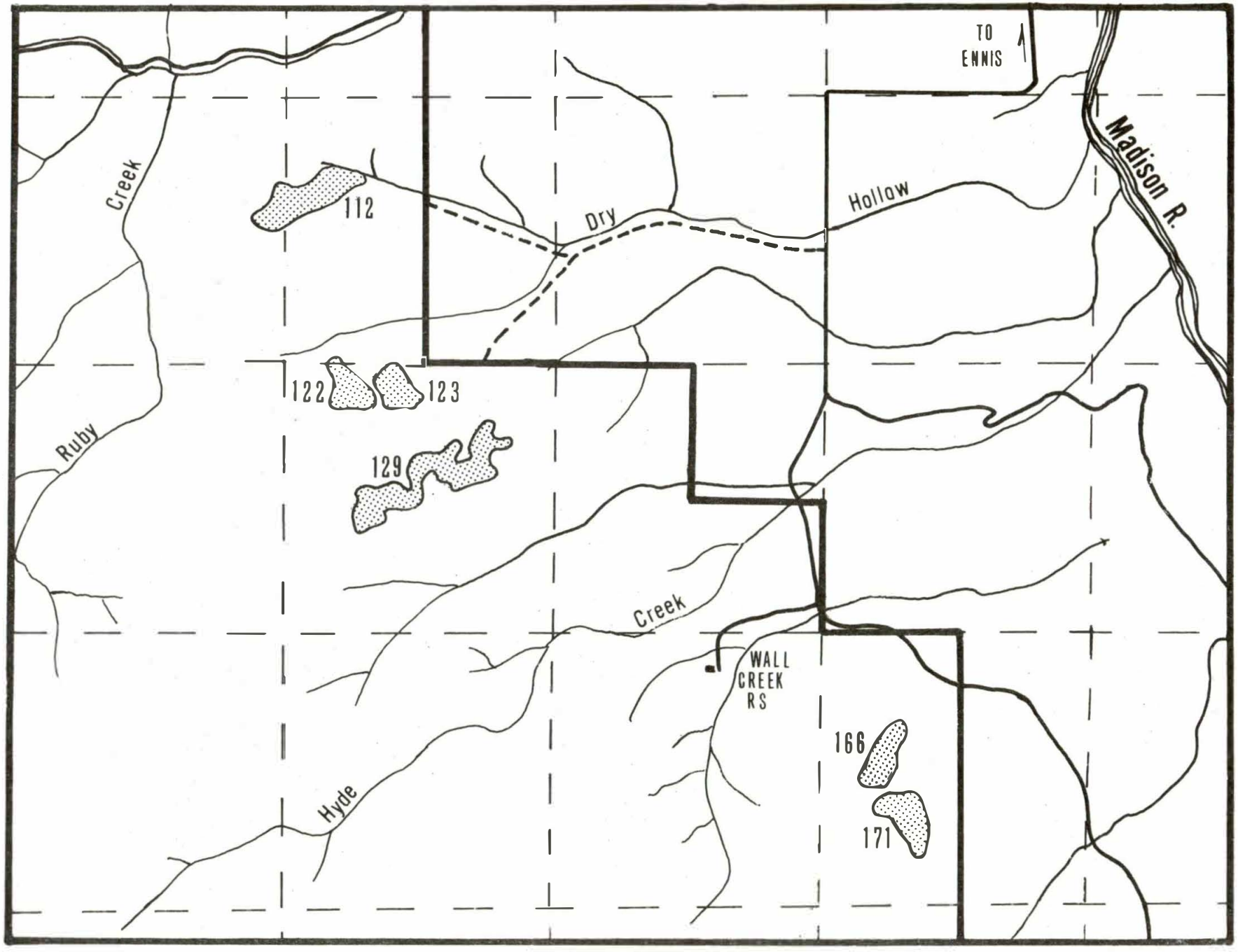
The objective of this evaluation is to provide documentation of defoliation and damage information over time. This information will provide a basis for testing models being developed by CANUSA and provide additional information on top kill and probability of budworm-caused mortality for east side Douglas-fir stands.

METHODS

After it was determined that the area was suitable for CANUSA research, large-scale color photography, 1:8,000, was used for stand mapping. Six stands were selected as a sample to represent the area (figure 1). Each stand was sampled by a systematic grid. At each grid point trees greater than 5 inches d.b.h. were selected for detailed measurements using a 40 BAF plot size. Trees less than 5 inches d.b.h. were tallied if within

1/ Canada-USA Expanded Spruce Budworm Research, Development and Application Program.

Fig. 1 WALL CREEK STANDS



6.8 feet of the plot center. Sample trees were marked with an aluminum nail at d.b.h. and spot painted at the base. A wood stake was placed at plot center for future reference.

Data taken on each tree include species, d.b.h., crown ratio, current defoliation, past defoliation, top kill, and tree history. Height and radial growth were taken on a sample basis. Habitat type was obtained for each plot but slope and aspect were recorded on a stand basis. A stand computation program, INDIDIS (Bousfield 1979), was used to expand tree characteristics to an acre basis. Regression analysis was used to measure the relationships between stand characteristics and damage symptoms.

RESULTS

The six stands are pure Douglas-fir except for a minor component of limber pine in two stands. Stand characteristics were different in all six stands. Basal areas ranged from a high of 166 to a low of 72 square feet of basal area per acre. Trees per acre ranged from 818 to 265. The most uniform characteristics were quadratic mean diameter and periodic annual growth (table 1).

Table I.--Wall Creek stand characteristics.

Stand ident.	Trees/ acre	Basal area	Cubic ft.vol.	Quadratic mean diameter 1/	Periodic annual increment 2/
112	411.9	72	843.9	6.1	43.3
122	277.3	146	212.8	9.8	42.9
123	265.0	160	3173.0	10.4	55.7
129	285.0	131	2602.0	9.2	46.6
166	368.0	115	146.6	7.6	38.6
171	818.0	166	2463.0	6.1	36.5

1/ Calculated from tree of mean basal area.

2/ Cubic ft. production based upon radial growth measurements and height growth equations.

Probability of mortality 2/ was computed by diameter class and was fit to Hoerl's special function (Daniel and Wood 1971).

2/ Three years' accumulative mortality.

The analysis showed that most of the mortality occurred in sapling size trees and that the probability of mortality was highest for the 2- to 4-inch diameter trees (table II).

Defoliation has been declining since 1979. The average defoliation of the six sample stands in 1979 was 68 percent but declined to 50 percent by 1981 (table III). Top killing occurred in all stands except one which had the lowest basal area. Average percent of basal area with top kill was 14.30 percent for all six stands. There was a relationship between the amount of basal area and percent top kill (table IV). Several forms of regression analysis were attempted and the best fit was explained by the following equation:

$$Y = \text{Exp}\left(a + \frac{b}{\text{Basal area}}\right)$$

a = 11.93
b = 1309.41
Y = Percent basal area with top kill

Although the r^2 value of .916 from this regression fit suggested that top killing is related to stand density, there were only six stands used in the analysis and more data is needed to substantiate this relationship.

CONCLUSIONS

Wall Creek has suffered several years of intense defoliation and most stands show visible signs of deterioration. Some mortality has occurred, but most of it is confined to the smaller diameter trees and will not reflect a large impact on periodic annual growth. Top killing was most pronounced in stands with the highest basal area. This might be caused by a combination of lower tree vigor and minimal larvae dispersal loss in the more dense stands.

REFERENCES

Bousfield, Wayne E.
1979. R-1 forest insect and disease damage survey system. USDA-For. Serv., Northern Region Rpt. 79-2, 14 p.

Daniel, Cuthbert and Fred S. Wood.
1971. Fitting equations to data. Wiley - Interscience.

Table II Probability of Mortality by Diameter

$$y = ax^b e^{cx}$$

$a = -\ 2.6574$

$b = 1.7752$

$c = -.5501$

$r^2 = .3701$

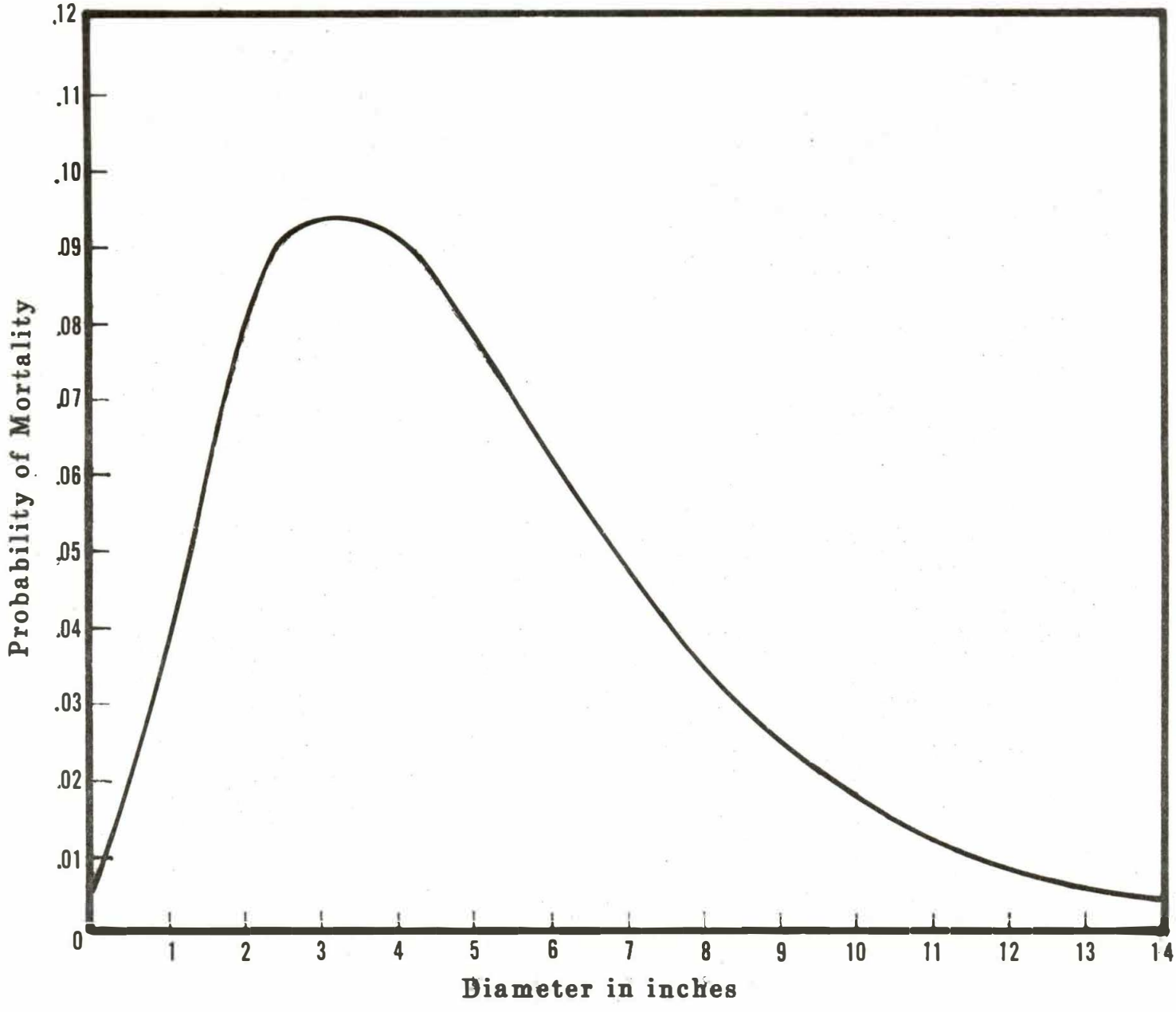


Table III

Percent Defoliation of Growing Stock

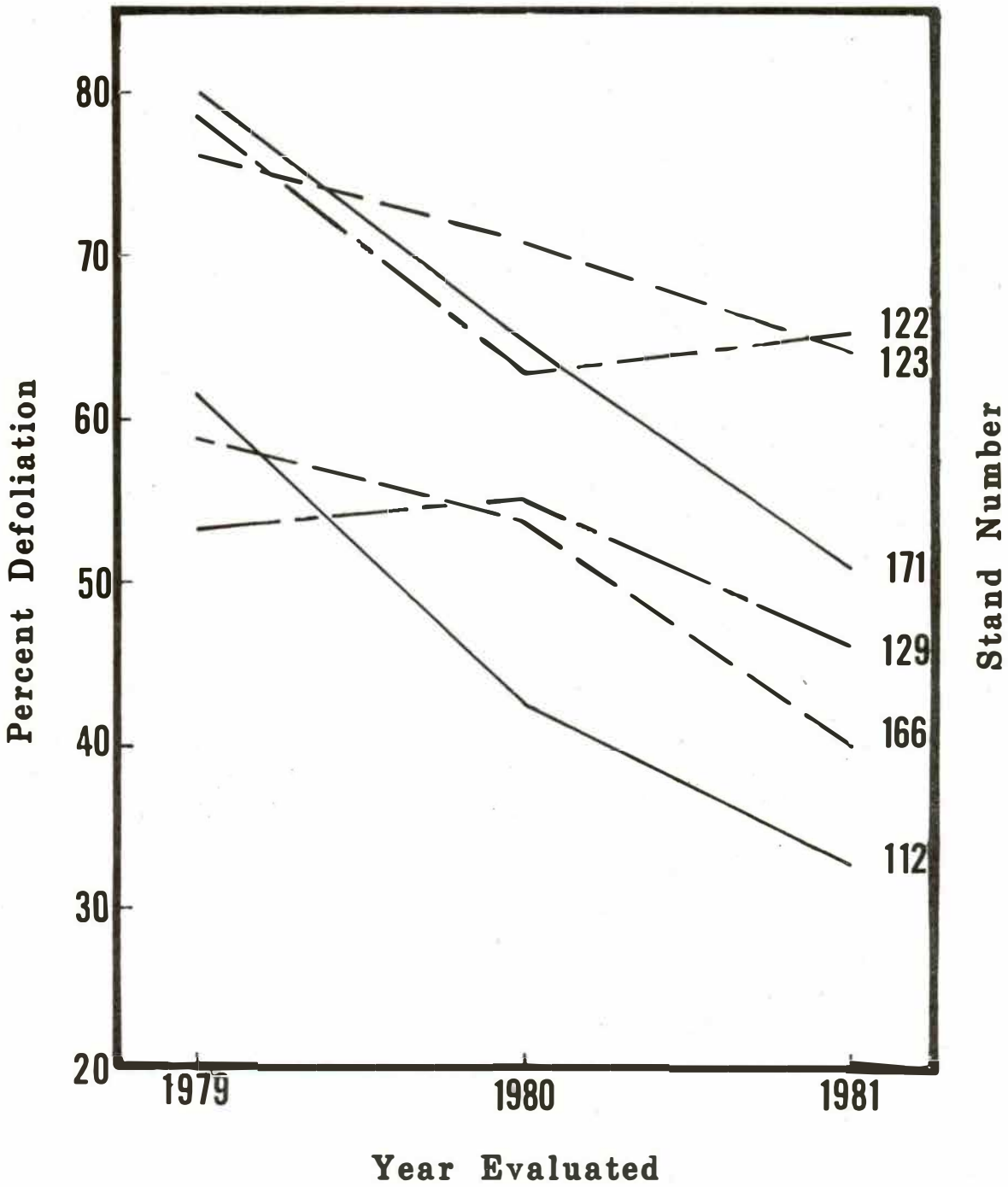


Table IV

Relationship of Basal Area to Top Kill

$$y = \mathrm{Exp}\left[a + b\frac{1}{\bar{x}}\right]$$

$a = 11.93$ $\quad b = -1309.41$

$x =$ Basal Area $\quad r^2 = .916$